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IN MEMORIAM

In Memoriam: Morris Kates (1923–2013)

Aharon Oren · Antonio Ventosa

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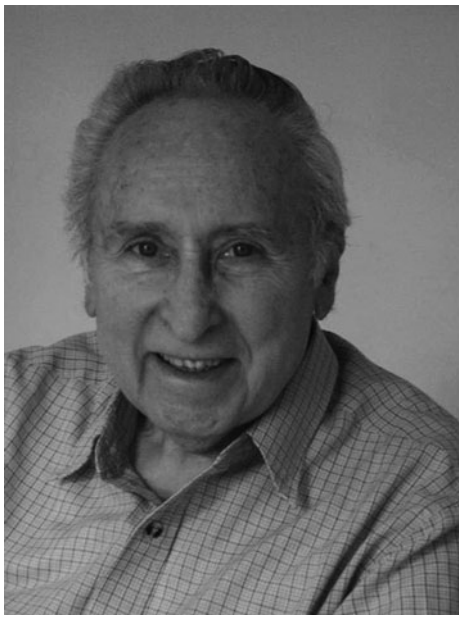

On March 7, 2013, Morris Kates passed away in his home in Ottawa, Canada, at the age of 89. Born in Galati, Romania, in 1923, he was brought to Canada one year later. He received his Ph.D. from the University of Toronto in 1948. From 1950 until 1968 he worked at the National Research Council of Canada, Ottawa, first as a post-doctoral fellow and then as a research scientist. In 1968, he was appointed Professor of Biochemistry at the University of Ottawa, and in 1989 he retired as Professor Emeritus.

The community of extremophile scientists will remember Morris Kates first of all because of his discovery of the isopranyl glycerol diether lipids of *Halobacterium* and other members of the *Halobacteriaceae*. Today we all associate the presence of such lipids with the archaeal domain, first defined by Carl Woese in 1977. The first evidence that the lipids of *Halobacterium* are substantially different from the acyl ester lipids of 'normal' bacteria was published by Morris and his coworkers in 1962 (Sehgal et al. 1962). As stated in the abstract: "Most of the phosphatide fraction (73 %) consists of a single component which is believed to be a long-chain ether analogue of diphosphatidyl glycerol." This finding was extended in many more detailed studies of the structure of the lipids of the red extreme halophiles now recognized as a group of Archaea (Kates et al. 1963 and many later studies). The unique structure of the ether lipids, shared with methanogens and many thermophilic and hyperthermophilic prokaryotes later provided a major support to Woese's three-domain model of the tree of life. Comparative studies of the ether lipids, especially the glycolipid fraction, of different isolates of extreme halophiles, led by Morris Kates and coworkers provided essential information that led to the recognition of new genera (*Haloferax*, *Haloarcula* and others) in the mid-1980s, and to the use of the polar lipid pattern as a taxonomic marker at the genus level in haloarchaea (Torreblanca et al. 1986). And, working with a phylogenetically different extreme halophile toward the end of his life, he participated in the structure elucidation of a complex novel sulfonolipid of *Salinibacter ruber* (Corcelli et al. 2004).

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A. Oren (✉)
Department of Plant and Environmental Sciences,
The Alexander Silberman Institute of Life Sciences,
The Hebrew University of Jerusalem, 91904 Jerusalem, Israel
e-mail: aharon.oren@mail.huji.ac.il

A. Ventosa
Department of Microbiology and Parasitology,
Faculty of Pharmacy, University of Sevilla,
41012 Sevilla, Spain

Fig. 1 Halophile scientists after a chamber music concert in Williamsburg, VA, in November 1992 (from left to right): Donn Kushner, Morris Kates, Aharon Oren, and Larry Hochstein

Among biochemists, Morris Kates is best known for his textbook 'Techniques in Lipidiology' (Kates 1972). In 2010, a third, revised edition of this classic book was published. Among his other books it is important to mention the monograph on "The Biochemistry of Archaea (Archaebacteria), edited jointly with Donn Kushner and Al Matheson (Kates et al. 1993). Altogether Morris wrote about 250 scientific papers on lipid biochemistry and lipid metabolism. Among the awards he received are the 1984 Supelco Award for lipid research from the American Oil Chemist Society.

Lipid biochemistry was one field in which Morris Kates was famous, music was the second. He started studying violin at the age of 11, and throughout his life he has been playing in orchestras and in chamber music ensembles. Morris has been composing music since he was a high school student, during his university studies he took courses in composition, harmony and counterpoint, and he has published more than 20 compositions that include orchestral works, chamber music, choral works, and more. He was an Associate Composer with the Canadian Music Centre and a member of the Canadian League of Composers (May 2008). During the symposia on halophilic microorganism he attended it became clear that his love for music making was shared by other colleague-scientists. The two chamber music evenings with Morris Kates during the halophile symposia held in Alicante, Spain, in 1989 and in Williamsburg, VA, in 1992 will always remain among our dearest memories of a wonderful scientist and a great colleague (Fig. 1).

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